REMARKS

In the last Office Action, the Examiner objected to use of the phrase "chemical fabricating process" in claims 1-3 and 10-12. The Examiner stated that the specification is enabling only for electrolytic etching. Claims 1, 2, 4, 5, 10, 11, 13 and 14 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,968,336 to Rolfson ("Rolfson"). The Examiner stated that Rolfson discloses a method of fabricating a part comprising a sacrificing layer forming step, a structural body material layer forming step, a part shape fabricating step carried out by a chemical fabricating process, and a part separating step, as recited in the claims (citing Figs. 3A-3K and col. 3, line 22 to col. 5, line 18). The Examiner further stated that Rolfson discloses that the part shape fabricating step includes a step of separating only the part from the structural body material layer along the outer configuration of the part by a chemical fabricating process involving the etching of a groove.

Claims 3, 6, 12 and 15 were rejected under 35 U.S.C. §103(a) as being unpatentable over Rolfson in view of U.S. Patent No. 6,350,360 to Bonivert et al. ("Bonivert"). Bonivert was cited as disclosing a process of fabricating a three-dimensional tool wherein a peeling layer is formed.

Claims 7-9 and 16-18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Rolfson and Bonivert in view of U.S. Patent No. 5,967,347 to Wakabayashi et al. ("Wakabayashi"). Wakabayashi was cited as disclosing a method of electrolytic machining using a machining electrode having a pertinent shape in a machining solution opposite to the structural body material layer.

By the present response, the specification has been suitably revised in editorial respects to correct informalities and improve the wording. Claims 1-18 have been canceled without prejudice or admission and replaced with new claims 19-42, which are revised versions of the original claims rewritten in formal respects to improve the wording and place them in better conformance with U.S. practice. The newly added claims do not recite a "chemical fabricating process" or "electrolytic etching" as suggested by the Examiner, and instead recite that the shaping process is performed by a machining process. Various dependent claims further recite the details of the machining process used in the preferred embodiments.

Applicants respectfully submit that claims 19-42 patentably distinguish over the prior art of record.

The present invention relates to a novel method of fabricating a part.

A conventional method of fabricating a part with a desired shape is generally performed by machining a part forming material utilizing a mechanical or electric discharge machining process to define the outer configuration of the part by removing unnecessary portions of the part forming material. When using a cutting tool, for example, either the cutting tool or the material is rotated while the cutting tool and material are brought into contact with each other so that the cutting tool may remove unnecessary portions of the material to define the desired shape of the part. When using electric discharge machining, a machining electrode is provided with a front end shaped to correspond to the shape to be formed, an interval between the machining electrode and the fabricating material is adjusted to a predetermined distance, and an electric discharge pulse is repeatedly produced therebetween so that a desired shape is obtained by removing unnecessary portions of the material. Fabrication of a part having a movable portion is generally performed by fabricating the individual elements separately and assembling them thereafter.

In addition, as shown by Figs. 3 and 4 of the application drawings, a method of forming a part having a movable portion may also be formed by a semiconductor technique by patterning a film deposited on a substrate in a

layered shape by photolithography. A sacrificial layer is deposited on a substrate and a part forming layer is deposited on the sacrificial layer of a material different from the sacrificial layer. The part forming layer is then patterned into a predetermined shape by a photolithographic process and removed from the substrate by selectively etching the sacrificial layer.

Each of the foregoing problems has unique drawbacks. Mechanical and electric discharge machining processes waste material and require a lengthy process. Fabrication of parts having complicated shapes requires the use of a large number of machines. There are also miniaturization limitations and problems associated with a large amount of wasted material.

Although the semiconductor lithographic process described above avoids the problems of machining processes, it is simply not possible to fabricate a part having a large thickness using conventional semiconductor etching techniques.

The present invention overcomes the foregoing problems by providing a process for fabricating a part comprising at least the steps of forming a part forming layer on a surface of a base material, shaping the part forming layer by a machining process to define an outer configuration of the part, and separating the shaped part from the base material to obtain the fabricated part.

More specifically, as recited by newly added independent claim 22, the inventive part fabricating method comprises the steps of forming a part forming layer on a base material of a material different from that of the base material, shaping the part forming layer by a machining process to define an outer configuration of the part, and separating the shaped part forming layer from the base material to obtain the fabricated part by selectively removing at least a portion of the base material.

Newly added independent claim 19 further recites the steps of forming a sacrificial material layer on a base material, forming the part forming layer on the sacrificial material layer, and separating the shaped part forming layer from the base material to obtain the fabricated part by selectively removing only the sacrificial material layer.

Newly added independent claim 25 recites the use of a peeling layer rather than a sacrificial layer for enabling separation of the shaped part from the base material.

Newly added independent claims 28, 31 and 34 are similar to claims 19, 22 and 25 described above, but recite methods of fabricating a part having a fixed portion that is fixed relative to the base material and a movable portion that is relatively movable with respect to the base material.

Accordingly, each of independent claims 19, 22, 25, 28, 31 and 34 requires the step of shaping a part forming

layer by a machining process to define an outer configuration of a part.

In the embodiment illustrated in Figs. 5A-5F of the application drawings, a copper thin film 502 having a thickness of at least .5 μm and serving as a sacrificial layer is formed by electroplating on a surface of a chromium substrate 501 serving as a base material. A part forming layer comprised of a nickel thin film is electroplated on the copper thin film. A groove having a desired depth and width is formed in the part forming layer using a machining electrode to define an outer configuration of the fabricated part. The shaped part is removed from the base material by etching only the copper sacrificial layer.

No corresponding method is disclosed or suggested by the prior art of record. Although the prior art discloses the known use of semiconductor fabrication techniques to form a part, the newly added independent claims require the use of a machining process to shape an outer configuration of the part or at least a movable portion thereof. The prior art contains no such disclosure.

For instance, Rolfson discloses a method of forming a lithographic stencil mask for use in ion beam and electron beam lithography. The method disclosed by Rolfson utilizes conventional semiconductor fabrication techniques as shown in Figs. 3A-3K, including a membrane forming process by backside

etching as shown in Fig. 4B. However, Rolfson fails to disclose or suggest a part shaping step utilizing a machining process to define an outer configuration of a part. All of the film shaping steps discloses by Rolfson are performed by photolithographic techniques involving the use of a photoresist mask and an etching solution.

Nor does Rolfson disclose or suggest the use of a sacrificial layer or a peeling layer as recited by independent claims 19, 25, 28 and 31. It is noted that the thin film 21 (N+/P- junction) of Rolfson is an etching stop layer and not a sacrificial layer which is etched to remove a part from a base material as required by the independent claims.

Neither Bonivert nor Wakabayashi cure the foregoing defects. Bonivert was cited as disclosing a part fabricating process utilizing a peeling layer. Wakabayashi was cited as disclosing a method of electrolytic machining. In this regard, Wakabayashi merely discloses the prior art use of machining in a general sense. Neither of the secondary references would have suggested modifying Rolfson to utilize a machining process in the claimed manner.

Accordingly, applicants respectfully submit that claims 19-42 patentably distinguish over the prior art of record.

In view of the foregoing amendments and discussion, the application is now believed to be in allowable form. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

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